بعض التغييرات البيوكيميائية في الخراف الهزيلة التي تعاني من نقص عنصر النحاس

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تم في هذا البحث تسجيل العلاقات الأكلينية وكذلك التغييرات البيوكيميائية في الخراف الهزيلة والتي تعاني من نقص النحاس.

وقد تبين أن هناك نقصاً ملحوظاً في مستوى عنصر النحاس، وكذلك في مستوى نشاط خميزة السيرولوبلازمين في الحيوانات المريضة. وقد لوحظ أن هناك ارتباط قوي (r = -0.73) بين عنصر النحاس ونشاط خميزة السيرولوبلازمين، مما يوضح مدى الاستفادة من قياس نشاط هذا الأنزيم كبدائل لتعويض مستوى عنصر النحاس في مصل الدم.
SOME BIOCHEMICAL ALTERATIONS IN UNTHRIFTINESS SHEEP SUFFERING FROM COPPER DEFICIENCY
(With 1 Table & 1 Fig.)

By
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SUMMARY

In this work, the clinical signs and some biochemical alterations of unthrifty sheep suffering from hypocuprosis as well as clinically healthy one were recorded. The diseased sheep were hypocupreanemic in comparison with control group. The mean values of blood serum copper and caeruloplasmin of diseased sheep were 130.85±8.42 mg’s and 80.75±0.58 U/L, respectively.

Strong positive correlation (r=0.973) was obtained between blood serum copper level and caeruloplasmin activity, indicating the usefulness of the activity of this enzyme as an alternative assay for copper deficiency.

INTRODUCTION

Copper is an essential nutrient for cattle and sheep. Signs of copper deficiency include poor growth, diarrhoea, unthriftiness loss of hair and wool colour, as well as enzootic ataxia in suckling lambs and fetal resorption (POOLE, 1963 and UNDERWOOD, 1977). The nutritional requirement of copper is 10 mg/kg. (National Research Council, 1978), but a conditioned copper deficiency can occur in ruminants when uptake and utilization of copper are distributed by other substances in the diet, such as molybdenum and sulphur (SUTTLE, 1974 and DICK et al, 1975) which reduce the availability of dietary copper due to the formation of molybdates in the rumen, which decrease its availability and impede its absorption and metabolism.

Activities of microelement-dependent enzyme have been used as alternatives to direct measurements of blood serum trace mineral concentrations. Caeruloplasmin has been as a copper dependent enzyme and to indicate plasma copper concentrations (PAYNER, 1982 and KINCAID, et al. 1986).

The purposes of the present study were to investigate the copper deficiency in unthrifty sheep and the usefulness of blood serum caeruloplasmin activity as an indicator of copper concentration in sheep.

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MATERIAL and METHODS

Animals:

Thirty-five ewes, 1-3 years old, presented to veterinary medical faculty of Edfina, Alexandria University, were used in this study. Ten ewes were used as control. These ewes were suffered from unthriftness, depraved appetite and weakness. Wool abnormalities were observed and recorded, including losses of wool crimp with steely appearance and loss of its colour. Some of them showed easily detachable wool with areas of alopecia, while some showed persistent diarrhoea in the form of watery, yellow-green to black faeces.

Faecal examination for the detection of ova of internal parasites was done using direct smear and the flotation technique a after SONNENWIRTH and JARETT (1980).

Blood samples:

Blood samples were drawn from the jugular vein into evacuated blood serum collection tubes, designed to minimize trace elements contamination. Blood was centrifugated and serum was collected into vials and frozen until used. All haemolysed samples were discarded.

Non haemolysed blood serum samples were used for estimation of copper, iron, caeruloplasmin, calcium, and inorganic phosphorus according to the methods of ZAK (1958); PICCARDI, et al. (1972), SCHOSINSKY, et al. (1974), GENDLER and KING (1972) and FISH & SUBBAROW (1925); respectively.

Statistical analysis of data for analysis of variance and polynomial regression coefficient was applied after SNEDECOR and COCHRAN (1980).

RESULTS

The clinical signs observed in the diseased ewes were in the form of unthriftness depraved appetite and weakness, as well as wool abnormalities including loss of wool crimp, loss of colour with steely appearance. Some of diseased ewes showed easily detachable wool, with areas of alopecia, while some showed persistent diarrhoea with the passage of watery, yellow-green to black faeces. Faecal examination revealed highly parasitic infestation of diseased ewes.

Table (1) and Fig. (1) showed the result of blood serum analysis for copper, caeruloplasmin activity, iron, calcium and phosphorus, as well as, relationship between copper concentration and caeruloplasmin activity.

Significant decrease (P < 0.01) in blood serum copper concentration and caeruloplasmin activity were recorded in diseased ewes in comparison with control group, with non significant decrease in blood serum iron, calcium and inorganic phosphorus concentration.

The relationship of copper concentration to caeruloplasmin activity was described by the quadratic equation:

\[ Y = 61.29 + 0.979X \]

With regression coefficient (r=0.973) indicating strong correlation between them.
COPPER DEFICIENCY IN SHEEP

DISCUSSION

In ruminants a deficiency of copper causes interference with tissue oxidation resulting in a wide range of clinical manifestations. In the present work, recorded clinical signs were those related to wool abnormalities, as loss colour (achromotrichia) in a feature of copper deficiency commonly seen in cattle and sheep (POOLE, 1963) and this is probably due to deficiency of the copper containing polyphenyl oxidase enzyme which catalyses the conversion of tyrosine to melanine. Moreover; loss of crimp and tensile strength wool occurs, because of failure to maintain normal disulfide groups used to provide cross linkages within the wool fiber.

Concerning biochemical alterations, Table (1) and Fig. (1) recorded a significant decrease in both blood serum copper concentration and caeruloplasmin activity in diseased sheep with a mean values of 105.7±2.91 μg% and 80.75±0.58 U/L, respectively. Non significant decrease was showed in the concentration of blood serum iron, calcium and inorganic phosphorus.

In the present study, a highly significant correlation between blood serum copper level and blood serum caeruloplasmin activity was observed. The regression coefficient (r=0.973), indicated strong positive correlation. Similar data for copper values in normal and diseased ewes were recorded by ABDEL-AZIZ (1979) and BLOOD, et al. (1983).

The explanation of low iron which is statistically non-significant based on the role of copper deficiency in impairment of iron transfer to the plasma from reticuloendothelial system in the liver, depending on adequate amounts of copper-containing oxidative enzyme (caeruloplasmin). Anaemia has been reported as an important sign in hypocuprosis, and the severity of anaemia will be related to the hypocupremia, GARDNER (1976).

The diagnostic value of caeruloplasmin or paraphenylenediamine oxidase in blood had been assessed (SRIVASTAVA and DWARAKNATH, 1971) and coincide with the results of the present work, indicating that the caeruloplasmin activity is very closely related under field condition, to blood serum copper, and appears to offer little more than an alternative assay, particularly due to difficulty in obtaining uncontaminated samples and on estimating blood copper levels.

REFERENCES


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**Table (1)**

Some biochemical alterations in Ewes suffering from copper deficiency

<table>
<thead>
<tr>
<th>State</th>
<th>Caeruloplasmin (U/L)</th>
<th>Copper (ug%)</th>
<th>Iron (ug%)</th>
<th>Calcium (mg%)</th>
<th>Phosphorus (mg%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>104.38</td>
<td>130.85</td>
<td>98.87</td>
<td>11.14</td>
<td>4.34</td>
</tr>
<tr>
<td></td>
<td>± 12.27</td>
<td>± 8.42</td>
<td>± 10.29</td>
<td>± 1.08</td>
<td>± 0.66</td>
</tr>
<tr>
<td>Diseased</td>
<td>80.75*</td>
<td>105.74*</td>
<td>88.00</td>
<td>9.48</td>
<td>3.87</td>
</tr>
<tr>
<td></td>
<td>± 0.58</td>
<td>± 2.91</td>
<td>± 12.55</td>
<td>± 0.59</td>
<td>± 0.61</td>
</tr>
</tbody>
</table>

* Significant at P/ 0.01.
Serum copper concentration (mg/dl)

adj. serum copper concentration in sheep.

Fig. 1. The relationship between serum copper concentration and activity.

\[ y = 61.29 + 0.979x \]

\[ y = 0.972 \]